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THE UNITED STATES PATENT AND TRADEMARK OFFICE

BOARD OF PATENT APPEALS AND INTERFERENCES

Attorney Docket No.: 40544.00301

In re: Gilchrist, et al.

Serial No.: 09/424,811

Title: Method of Producing Water-Soluble Glass Fibers

Filed: 30 November 1999

Art Unit: 1731

Assistant Commissioner of Patents
Washington, DC 20231

APPEAL BRIEF

INTRODUCTION

This Appeal Brief is being filed within the time limit pursuant to 37 C.F.R. 1.192. The Applicants (Appellants) address herein the comments made by the Examiner in his Office Action dated September 13, 2001, deemed final, rejecting all of the claims pending in the application. Applicant filed an amendment after final, dated February 13, 2002, which was not entered onto the record by the Examiner.

REAL PARTY IN INTEREST

The real party of interest is Giltech Ltd., (U.K.) assignee from the inventors, Thomas Gilchrist and David Michael Healy.

RELATED APPEALS AND INTERFERENCES

No other appeal or interference exists involving the application identified in the caption of this brief is known to the inventors or the assignee of the inventors which will directly affect or be directly affected or have a bearing on the Board's decision in the pending appeal.

STATUS OF THE CLAIMS

Pending claim 1 has been amended once.

Pending claim 2 is pending as originally filed in the application.

Pending claims 3 through 8 have been amended once.

Claim 9 has been cancelled.

Pending claim 10 has been amended once.

Pending claims11-15 are pending as originally filed in the application.

Claims 16 through 20 have been cancelled.

STATUS OF THE AMENDMENTS

The amendment filed after the final Official Action dated September 13, 2001 has not been entered.

The assignee has filed a petition to invoke the supervisory authority of the Commissioner of Patents which outlines the prosecution of the application and summarizes the errors which were made by the examiner in the prosecution of the application regarding; (a) the refusal of the examiner to consider the Information Disclosure Statement dated June 23, 2000 and related documents, (b) suggesting the applicant had submitted deceptive or erroneous information to the United States Patent and Trademark Office and (c) refusing to consider the

applicants' response to the final rejection. Further, the petition presents arguments which support actions requests by the applicant concerning the errors by the examiner in the prosecution of the application.

SUMMARY OF THE INVENTION

The present invention provides a method for forming a water soluble glass fibre and/or glass wool, the method comprising producing a water soluble glass and heating said glass above its melting point to form molten glass (page 4, lines 23-27), cooling at least a portion of said molten glass to a pre-selected working temperature (page 4, lines 28-36, and page 5, line 1) and then processing said molten glass having said working temperature into fibres and/or wool (page 5, lines 14-36 and page 6, lines 1-5).

ISSUES

Whether claims 1-8 and 10-15 are unpatentable under 35 U.S.C. § 112, first paragraph as containing subject matter which was not described in the specification in such a way as to reasonably convey to one skilled in the relevant art that the inventor(s) at the time the application was filed, had possession of the claimed invention.

Whether claims 1-8 and 10-15 are unpatentable under 35 U.S.C. § 103 over Gilchrist (U.S. patent no. 5,470,585) in view of Lowenstein (The Manufacturing Technology of Continuous Glass Fibres).

GROUPING OF THE CLAIMS

The claims of the application do not stand or fall together.

ARGUMENT

(i) Rejections based on 35 USC 112, first paragraph

Claims 1–8 and 10–15 were rejected under 35 USC 112, first paragraph, as containing subject matter which was not described in the specification.

The subject matter defined by each of the rejected claims refers to a method for forming water-soluble ion releasing glass fibers. The examiner has erred in rejecting the amended claim 1 (which all other rejected claims directly or indirectly depend) based on the lack of "support for the new limitation of maintaining the temperature of the portion at the working temperature".

Support for the working temperature is found in the specification; the **preselected working temperature of 400 to 900°C, is referred to on page 4, lines 31 to 32.** Preferable ranges for the "working temperature" are found on page 4, lines 30 to 34 to satisfy the best mode requirement. Further, the limitation disclosed in the specification will give detailed guidance to one skilled in the art to make and use the invention.

Claim 2, which directly depends from claim 1, is separately patentable because it further defines the rate at which the molten glass recited in claim 1 is cooled.

Claim 3, which directly depends from claim 1, is separately patentable because it recites a preferred working temperature range.

Claim 4, which directly depends from claim 1, is separately patentable because it recites a working temperature based on the temperature of the glass as initially heated.

Claim 5, which directly depends from claim 1, is separately patentable because it recites the forming of glass wool.

Claim 6, which directly depends from claim 1, is separately patentable because it recites phosphorous pentoxide as a glass former.

Claim 7, which directly depends from claim 6, is separately patentable because it recites boron containing compounds are used as glass modifiers.

Claim 8, which directly depends from claim 7, is separately patentable because it recites a glass modifier at a particular molar percentage.

Claim 10, which directly depends from claim 1, is separately patentable because it recites silver orthophosphate is added during manufacture of the glass as a source of silver ions.

Claim 11, which directly depends from claim 2, is separately patentable because it recites a working temperature of the glass.

Claim 12, which directly depends from claim 2, is separately patentable because it recites a working temperature based on the temperature of the glass as initially heated.

Claim 13, which directly depends from claim 3, is separately patentable because it recites the forming of glass wool with the limitation of claim 3.

Claim 14, which directly depends from claim 5, is separately patentable because it recites phosphorous pentoxide as a glass former with the limitation of claim 5.

Claim 15, which directly depends from claim 1, is separately patentable

because it recites boron containing compounds are used as glass modifiers.

(iv) Rejections based on 35 USC 103

Claims 1 to 8 and 10 to 15 were rejected under 35 U.S.C. 103(a) as being obvious over Gilchrist (US 5470585) in view of Loewenstein (The Manufacturing Technology of Continuous Glass Fibres, 1983) and Tooley (Handbook of Glass Manufacture, 1954). The Examiner considers that Gilchrist teaches that water soluble glass fibers may be formed by conventional methods.

The Examiner states that Gilchrist discloses the invention of fibers which are dissolvable and quotes Claims 1 and 3 to support his position. Whilst Gilchrist refers to a water soluble glass, and reference is made to that glass being in the form of "fibres", the examiner has erred in not recognizing Gilchrist fails to teach how such fibers are manufactured. The use of conventional methodology was in fact successful in only providing short brittle fibers from such compositions. The difficulty in using the conventional "heat and pull" method is that a phosphorous pentoxide water soluble glass composition remains of suitable viscosity for pulling for only a very short period, typically a few minutes, before crystallization. This contrasts to silicon dioxide based glasses conventionally used for fiber formation which may remain suitable for pulling for several hours. This problem of forming fibers from phosphorous pentoxide water soluble glass compositions had not been fully understood or elucidated prior to the date of the current Application.

It should be noted that the temperatures (as recited in the independent claim) to which the water soluble glass is heated prior to pulling and also the working temperatures (as also recited in the independent claim) to which the molten glass is cooled are considerably lower than the temperatures used for non-phosphorous pentoxide based non-water soluble glass compositions as referred to in the two secondary references, Loewenstein and Tooley et al. The establishment of the correct temperature for pulling the glass fibres is not a

simple "routine experimentation" suggested by the Examiner. In fact, this issue of the correct temperature goes to the very heart of this invention. The difficulty is that the phosphorous pentoxide water soluble glass compositions under consideration here commence crystallization at or around the viscosity at which pulling can occur and that such crystallization is then very rapid.

Applicant submits that the Examiner's statement that "a glass is a glass is a glass" is naive. Loewenstein, one of the references cited by the Examiner in support of the 35 USC 103 objection, states on page 33 that:

> "over 99% of all continuous glass fibre produced is of "E" glass type composition".

Other types of glass compositions are then discussed. None of these glass compositions are phosphorous pentoxide water soluble glass, but instead use silicon dioxide as the glass former. Thus, from the reference cited by the Examiner, it is clear that the persons of ordinary skill in the art had only succeeded in providing glass fibers from silicon dioxide compositions, none of which correspond to the glass composition under consideration here. Indeed, Applicant encloses an extract from Matweb.com for E-Glass fiber which indicates that the glass comprises 54.3% SiO_2 and has a melting point of 1725°C, well outside the range specified in the present invention.

As the viscosity of the molten non-water soluble glass compositions is so high, it is problematic to draw such compositions into fibers. The Examiner states that it would be obvious to one skilled in the art to cool glass that is too fluid to form into glass to have the appropriate viscosity. However Applicant submits that this view is overly simplistic; the steep temperature viscosity gradient of the particular glass compositions covered here mean that the composition will quickly become too viscous to pull. Additionally, due to the particular chemical composition of phosphorous pentoxide based glasses, there

is a great tendency for the compositions to crystallize at or about the temperature of fiber formation and thus prevent fiber formation. Hence, the temperature ranges specified need to be carefully observed.

Gilchrist discloses a water-soluble glass able which releases silver ions. Only conventional methods of manufacture are disclosed (column 4, lines 42 to 49 of Gilchrist '585). Conventional methods of forming water-insoluble glass fibers are not successful when used to process water-soluble glass formulations. No examples in the Gilchrist reference disclose formation of glass fibers. Hence Gilchrist does not disclose or suggest suitable methodology for the formulation of a water-soluble silver ion-releasing glass fiber.

The Examiner asserts that it would have been obvious to one skilled in the art at the time of the invention to manufacture the glass of Gilchrist using the methods disclosed in either Tooley or Loewenstein. Applicant disputes this.

Tooley does not relate to manufacture of water-soluble glass fibers, but to manufacture of non-soluble, bulky, silicon dioxide-based glass objects like bottles (see page 374). As such Tooley relates to an altogether different technology--manufacture of insoluble silicon dioxide-based glass (see Tooley's examples on pages 243, for which Tooley's results are set forth in his Figures IX-B-2 and IX-B-3)--than the invention as presently claimed. One ordinarily skilled in the art of manufacture of phosphorus pentoxide-based soluble glass would have had no motivation to find, much less combine the teachings of, a document primarily disclosing a method of manufacturing silicon dioxide-based water-insoluble glass bottles (Tooley) with the teachings of a document disclosing water-soluble glass containing and releasing silver ions (Gilchrist).

At the time of the invention it was understood that water-soluble glass fibers could not be formed by conventional glass making techniques. For instance, the fibers formed by the method of US 4,604,097 (referred to on page

3, lines 5-10 of this application) have a very low tensile strength. The ordinarily skilled worker would have been prejudiced against using a method to manufacture non water-soluble silicon dioxide-based glass bottles to manufacture water-soluble phosphorus pentoxide-based glass fibers. There is no suggestion in any of the cited prior art documents that the method of Tooley would prove to have utility in this field with these materials.

The method described in Tooley involves the steps of heating the glass forming composition above its melting point, and then cooling it to a working temperature. The working temperature is defined in terms of the viscosity of the glass.

In further response to the Examiner's comments, the present invention clearly discloses the step of maintaining the molten glass at the working temperature. The method of Tooley involves cooling the molten glass to a working temperature where the working temperature is cool enough to allow the glass articles to be formed, presumably by glass blowing or casting. Tooley neither discloses nor suggests maintaining the glass at the working temperature before processing. Neither does Tooley disclose processing the molten glass at the working temperature into fibers.

Tooley does not relate to water soluble glass, nor does Tooley relate to silver ion-releasing glass. Tooley relates to silicon dioxide-based insoluble glass. It would not have been obvious to one ordinarily skilled in the art to combine Gilchrist with Tooley and there was no suggestion or motivation to do so. Furthermore Applicant submits that the combination of Tooley and Gilchrist would not lead one ordinarily skilled in the art to the present invention since the step of maintaining the molten glass at the working temperature and the step of processing the molten glass into fibers are not disclosed or suggested.

Loewenstein relates to glass compositions and methods of continuous

glass fiber manufacture. Loewenstein discloses a method of manufacturing long lengths of water-insoluble glass fibers typically for electrical applications. As such, Loewenstein is no more relevant to the patentability of this invention than the prior art noted in applicant's specification, namely conventional pulling techniques as mentioned on page 2, line 14 of the application.

Moreover, Loewenstein, being concerned with production of long, continuous fibers for electrical and optical applications, where fiber length is paramount, is not concerned and would not be of interest to one of ordinary skill in the art to which this invention pertains--the creation of water-soluble short fibers of phosphorus pentoxide-based glass, suitable for biological, as contrasted to electrical, applications. For biological applications, unlike in electrical applications, fiber length is not a consideration. In biological applications, to which the fibers of the invention are directed and will be used, long length is not a requirement and in many cases would do nothing but require another step in the manufacturing procedure—that being the step of cutting the fibers to a shorter length so that they could be implanted or combined with a carrier for implantation, etc. Hence, a worker in the biological field, being unconcerned with longer fibers and in fact trying to produce relatively short fibers, would shy away from even consulting a work such as Loewenstein's which is concerned with manufacture of such "continuous" fibers.

It would not have been obvious to one skilled in the art at the time of the invention to combine the teachings of Loewenstein with those of Gilchrist. As described above, at the time of the invention it was understood that water-soluble glass fibers, such as the phosphorous pentoxide-based soluble glasses of the preferred embodiment of this invention, do not lend themselves to conventional silicon dioxide-based water-insoluble glass-making methods, which have a very different chemistry. As such, the ordinarily skilled worker in the biological research field specializing in water soluble glasses would have been prejudiced against combining these two documents.

The method disclosed in Loewenstein involves the step of heating a composition suitable for producing a water-insoluble glass above its melting point. Loewenstein teaches that the temperature of the glass should stay constant or fall slightly (see page 103, lines 2 and 3). The temperature of the glass composition is reduced slightly while in the furnace to ensure that all of the glass is heated thoroughly (see Fig. IV/29). This is part of the heating stage. There is no suggestion that cooling and maintaining the molten glass at a lower temperature allows better quality glass fibers to be obtained.

Loewenstein does not disclose or suggest the step of maintaining a portion of the molten glass at the working temperature. As the Examiner indicated, this is an important step in the method of the present invention. Also, Loewenstein makes no mention of water-soluble silver ion-releasing glass fibers.

Claim 2, which directly depends from claim 1, is separately patentable because it further defines the rate at which the molten glass recited in claim 1 is cooled. The recited references are not concerned with nor do they give any guidance regarding the working temperature or the manner in which the working temperature is reached.

Claim 3, which directly depends from claim 1, is separately patentable because it recites a preferred working temperature range. The recited references are not concerned with nor do they give any guidance regarding the working temperature or the manner in which the working temperature is reached.

Claim 4, which directly depends from claim 1, is separately patentable because it recites a working temperature based on the temperature of the glass as initially heated. Defining the working temperature in relation to the temperature of the glass as initially heated is not discussed in the recited art.

Claim 5, which directly depends from claim 1, is separately patentable because it recites the forming of glass wool. The production of glass wool fibers by the method of the present invention as recited in claim 1 is not disclosed in the recited references.

Claim 6, which directly depends from claim 1, is separately patentable because it recites phosphorous pentoxide as a glass former. Using phosphorous pentoxide as a glass former by the method of the present invention as recited in claim 1 is not disclosed in the recited references.

Claim 7, which directly depends from claim 6, is separately patentable because it recites boron containing compounds are used as glass modifiers. Using phosphorous pentoxide as a glass former and boron containing compounds as glass modifiers by the method of the present invention as recited in claim 1 is not disclosed in the recited references.

Claim 8, which directly depends from claim 7, is separately patentable because it recites a glass modifier at a particular molar percentage. Using phosphorous pentoxide as a glass former and boron containing compounds as glass modifiers having a particular molar percentage by the method of the present invention as recited in claim 1 is not disclosed in the recited references.

Claim 10, which directly depends from claim 1, is separately patentable because it recites silver orthophosphate is added during manufacture of the glass as a source of silver ions. The production of water soluble ion releasing glass fiber using silver orthophosphate by the method of the present invention as recited in claim 1 is not disclosed in the recited references.

Claim 11, which directly depends from claim 2, is separately patentable because it recites a working temperature of the glass. The recited references are

not concerned with nor do they give any guidance regarding the working temperature or the manner in which the working temperature is reached. Further, the recited references do not discuss the cooling rate of the glass to the working temperature as recited in claim 2.

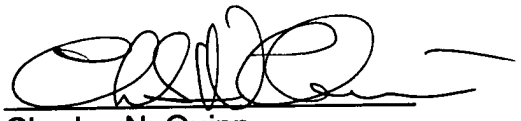
Claim 12, which directly depends from claim 2, is separately patentable because it recites a working temperature based on the temperature of the glass as initially heated. Defining the working temperature in relation to the temperature of the glass as initially heated is not discussed in the recited art.

Claim 13, which directly depends from claim 3, is separately patentable because it recites the forming of glass wool. The production of glass wool fibers by the method of the present invention as recited with the limitation in claim 3 is not disclosed in the recited references.

Claim 14, which directly depends from claim 5, is separately patentable because it recites phosphorous pentoxide as a glass former. The production of glass wool fibers using phosphorous pentoxide as a glass former by the method of the present invention as recited with the limitations of claim 5 is not disclosed in the recited references.

Claim 15, which directly depends from claim 1, is separately patentable because it recites boron containing compounds are used as glass modifiers. The production of glass wool fibers using phosphorous pentoxide as a glass former and boron containing compounds as glass modifiers by the method of the

present invention as recited in claim 1 is not disclosed in the recited references.



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APPENDIX

1. A method for forming water-soluble silver ion releasing glass fibers, the method comprising providing a composition suitable for producing a water-soluble silver ion releasing glass and heating said composition above the melting point of said glass to form a molten glass, cooling at least a portion of said molten glass to a preselected working temperature, maintaining the temperature of the portion of said molten glass at the working temperature and then processing said molten glass having said working temperature into fibers.

2. A method as claimed in Claim 1 wherein said portion of said molten glass is cooled slowly to said working temperature.

3. A method as claimed in Claim 1 wherein said working temperature is 50-300°C above the Tg of the glass.

4. A method as claimed in Claim 1 wherein said working temperature is at least 200°C below the temperature to which the glass is initially heated.

5. A method as claimed in Claim 1 wherein glass wool is formed.

6. A method as claimed in Claim 1 wherein phosphorous pentoxide is used as the glass former.

7. A method as claimed in Claim 6 wherein boron containing compounds are used as glass modifiers.

8. A method as claims in claim 7 wherein B_3O_3 is used as a glass modifier at a mole percentage of 15% or less.

9. Cancelled.

10. A method as claimed in Claim 1 wherein silver orthophosphate is added during manufacture of the glass as a source of silver ions.

11. A method as claimed in Claim 2 wherein said working temperature is 50-300°C above the Tg of the glass.

12. A method as claimed in Claim 2 wherein said working temperature is at least 200°C below the temperature to which the glass is initially heated.

13. A method as claimed in Claim 4 wherein glass wool is formed.

14. A method as claimed in Claim 5 wherein phosphorous pentoxide is used as the glass former.

15. A method as claimed in Claim 1 wherein boron containing compounds are used as glass modifiers.

16. Cancelled.

17. Cancelled.

18. Cancelled.

19. Cancelled.

20. Cancelled.